

CLAIMS

I/WE CLAIM:

1. An apparatus for the air-to-air transfer of at least one ordnance unit from a first airborne aerial vehicle to a second airborne aerial vehicle, the apparatus comprising:

an ordnance storage rack within a cargo space of the first airborne aerial vehicle to provide pre-transfer storage space to an at least one ordnance unit;

pylon installed on the second airborne aerial vehicle and intended to receive an at least one ordnance unit transferred from the first airborne aerial vehicle to the second airborne aerial vehicle;

an at least one transferable ordnance unit positioned prior to transfer on the ordnance storage rack located within the cargo space of the first airborne aerial vehicle;

an extendible arm assembly attached to the first airborne aerial vehicle, the arm first end is attached to the body of the first airborne aerial vehicle, the arm second end provided with freedom of movement;

an ordnance transfer assembly moveable along substantially the length of the arm, providing for the carriage of the at least one ordnance unit from the first airborne aerial vehicle to the second airborne aerial vehicle; and

a power generator device to provide power for the movement of the arm and the ordnance transfer assembly.

2. The apparatus of claim 1 further comprising an ordnance transfer control assembly providing for the control of the arm and the ordnance transfer assembly to enable controlling the movement of the extended arm in a bi-directional, multi-axis movement.

3. The apparatus of claim 1 wherein the ordnance storage rack comprises an at least one disposed storage cradle to hold the at least one ordnance unit and disposed supporting members to support the at least one disposed storage cradle.

4. The apparatus of claim 1 wherein the at least one ordnance unit is an aerial bomb device intended to be released, dropped or ejected from the second aerial vehicle toward a target.

5. The apparatus of claim 1 wherein the at least one ordnance unit is a missile device to be launched from the second aerial vehicle toward a target.

6. The apparatus of claim 1 wherein the ordnance transfer control assembly comprises:

a computer device having a memory device to hold software programs associated with the control of the movement of the extendible arm;

a communication device to transfer bi-direction control data, command data and positional information between the first aerial vehicle and the extendible arm;

thereby enabling control for an air-to-air transfer of the at least one ordnance unit from the first aerial vehicle to the second aerial vehicle.

7. The apparatus of claim 1 wherein the extendible arms assembly further comprises a foldable aerodynamic control surface assembly to provide for aerodynamic lift and control to the extendible arm.

8. The apparatus of claim 1 wherein the extendible arm assembly further comprises an at least one image acquiring device to provide the arm position-specific images to the ordnance transfer control assembly.

9. The apparatus of claim 8 further comprising an at least one lighting device to enhance the quality of the arm position-specific images provided to the ordnance transfer control assembly during ordnance transfer occurring under reduced quality lighting conditions.

10. The apparatus of claim 8 further comprising an at least one night vision device to provide enhanced quality mechanical arm position-specific images during day and nighttime ordnance transfer.

11. The apparatus of claim 1 wherein the extendible arm assembly further comprises:

bi-directional movement providing means to drive the arm assembly from or to the first aerial vehicle; and

multi-axis movement providing means to control the arm assembly unit along several axes;

thereby enabling bi-directional and multi axis movement and control of the extendible arm within a trajectory between the first airborne
5 aerial vehicle and the second airborne aerial vehicle.

12. The apparatus of claim 1 wherein the extendible arm assembly comprises at least two interlinked arm sections coupled together by at least one motorized joints to provide for the movement of the interlinked arm sections in respect to each other.

10 13. The apparatus of claim 1 wherein the ordnance transfer assembly comprises:

an ordnance carriage cradle for an in-transfer storage of the at least one ordnance assembly, the ordnance carriage cradle comprising
at least two ordnance gripping arms;

15 a pylon adapter to carry the at least one ordnance unit during an air-to-air ordnance transfer, the pylon adapter comprising:

a mechanical connector to the pylon;
at least one stabilizing surface to be used for stabilizing the pylon adapter to the pylon; and

20 a multi-fuzing unit to enable fuzing of the at least one transferred ordnance unit.

14. The apparatus of claim 1 wherein the extendible arm is an extendible telescopic probe assembly comprising at least two telescopic tubes with the base of the assembly attached to the first aerial vehicle and the
25 innermost telescopic tube linked to an arm assembly.

15. The apparatus of claim 14 wherein the arm assembly comprises at least two interlinked mechanized arm sections joined by motorized links and providing movement of the mechanized arm sections in respect of each other.

30 16. The apparatus of claim 12 wherein the arm assembly comprises a transferable ordnance assembly connected to the second end of the d arm assembly, the transferable ordnance assembly comprising an ordnance carrier cradle equipped with gripping arms to secure a transferable ordnance assembly to the ordnance carriage cradle.

17. The apparatus of claim 16 wherein the transferable ordnance assembly comprises a pylon adapter unit carried by the ordnance carriage cradle, the pylon adapter unit to carry an at least one ordnance unit and to be attached to a pylon uploaded on a weapon station on the second airborne aerial vehicle.

18. The apparatus of claim 1 wherein the extendible arm is an extendible boom assembly attached at one end to the first airborne aerial vehicle, the boom assembly comprising:

- an internally mounted ordnance conveyor mechanism enclosed in a rigid or semi-rigid tube for the feeding of the at least one ordnance unit from the first airborne aerial vehicle to the second airborne aerial vehicle;

- at least one foldable aerodynamic lifting and control surface to provide for the controlling of the boom assembly; and

- an ordnance carriage cradle installed at the second end of the boom assembly.

19. The apparatus of claim 1 wherein the extendible arm comprises at least two interlinked arm sections having at least one motorized joints to provide for the movement of the interlinked arm sections in respect to each other, the arm comprising:

- an externally mounted ordnance conveyor mechanism enclosed in a rigid or semi-rigid tube connected to the at least two interlinked mechanized arm section to provide for the feeding of an at least one ordnance unit from the first airborne aerial vehicle to the second airborne aerial vehicle;

- an at least one aerodynamic lifting and control surface to control maneuvering of the extended arm; and

- an ordnance carriage cradle installed at the second end of the arm to receive an at least one ordnance unit fed by the ordnance conveyor mechanism and attach the at least one ordnance unit to a pylon attached to a weapon station on the second airborne aerial vehicle.

20. The apparatus of claim 1 wherein the extendible arm comprises an at least two arm sections joined by at least one mechanical joint to provide for the slideable movement of the at least two arm sections in respect to each other, the extendible arm comprising:

a first arm section attached to the body of interior cargo space of the first airborne aerial vehicle via a flexible base unit that provides freedom of multi-axis movement;

one or more intermediate arm sections to connect the first arm section to a second arm section;

a second arm section comprising a foldable aerodynamic control surface assembly to provide for the lift for the ordnance and aerodynamic control of the arm during movement of the arm between the first airborne aerial vehicle and the second airborne aerial vehicle;

at least one actuator unit to provide for slideable movement of the arm sections in respect to each other;

an externally mounted ordnance conveyor mechanism to provide for the transfer of the at least one ordnance unit from the first airborne aerial vehicle to the second airborne aerial vehicle, the ordnance conveyor mechanism comprising:

a moveable ordnance carriage cradle device to carry the at least one ordnance unit along the extended mechanical arm from the first arm section of the mechanical arm via the intermediate arm sections of the mechanical arm to the second arm section of the mechanical arm in order to transfer the at least one ordnance unit between the first airborne aerial vehicle and the second airborne aerial vehicle; and

at least two movement direction bars extended along the mechanized arm sections in order to provide support and direction to the moveable ordnance carriage cradle device; and

a power generator to provide power for the movement of the ordnance carriage cradle device along the at least two interlinked arm sections of the arm.

21. The apparatus of claim 20 wherein the moveable ordnance carriage cradle device coupled to the ordnance conveyor mechanism associated with the arm, the ordnance carriage cradle device comprising:

a cradle body to support operational elements of the ordnance carriage cradle device;

at least two ordnance unit positioning bars to provide upward movement to the at least one ordnance unit where the ordnance unit is positioned in relation to the pylon;

at least two ordnance unit gripping arms to hold the at least one ordnance unit on the ordnance carriage cradle during the transfer of the at least one ordnance unit between the first airborne aerial vehicle and the second airborne aerial vehicle; and

a guidance boom device attached to the cradle body to provide in the final phase of the ordnance transfer the establishment of contact with an engagement rod installed on the pylon.

22. The apparatus of claim 1 wherein the first airborne aerial vehicle is a manned cargo aircraft.

23. The apparatus of claim 22 wherein the first airborne aerial vehicle is a Lockheed Martin C-130 Hercules.

24. The apparatus of claim 1 wherein the first airborne aerial vehicle is an unmanned or an uninhabited aircraft.

25. The apparatus of claim 1 wherein the second airborne aerial vehicle is a manned aircraft.

26. The apparatus of claim 1 wherein the second airborne aerial vehicle is an unmanned or uninhabited aerial vehicle.

27. The apparatus of claim 1 wherein the first aerial vehicle and the second aerial vehicle are space platforms.

28. A method for the air-to-air transfer of at least one ordnance unit from a first airborne aerial vehicle to a second airborne aerial vehicle, the method comprising:

loading an at least one ordnance unit or an at least one ordnance assembly into an ordnance storage rack installed within an internal cargo space of the first airborne aerial vehicle;

transferring the at least one ordnance unit or the at least one ordnance assembly from the ordnance storage rack installed within the cargo space of the first airborne aerial vehicle into an ordnance carriage cradle associated with a manipulable, extendible arm secured at the first end to the body of the first airborne aerial vehicle while the second end is provided with a freedom of movement to enable bi-directional, multi-axis

movement of the second end between the first airborne aerial vehicle and the second airborne aerial vehicle;

manipulating the extendible arm and the associated ordnance conveyor mechanism to provide for the bi-directional, multi-axis movement of the arm between the first airborne aerial vehicle and the second airborne aerial vehicle.

29. The method of claim 28 further comprising:

establishing contact between the at least one ordnance unit or the at least one ordnance assembly and the second airborne aerial vehicle; and

attaching the at least one ordnance unit or the at least one ordnance assembly to the pylon of the second airborne aerial vehicle.

30. The method of claim 28 further comprising establishing contact between the second end of the arm and the second airborne aerial vehicle via the manipulation of the arm.

31. The method of claim 28 further comprising uploading the ordnance unit on an external or internal weapon station on the second airborne aerial vehicle.

32. The method of claim 28 further comprises:

disconnecting the second end of the arm from the at least one ordnance unit or from the at least one ordnance assembly;

stabilizing the at least one ordnance unit or the at least one ordnance assembly to the pylon; and

fuzing the at least one ordnance unit or the at least one ordnance unit attached to the at least one ordnance assembly.

33. The method of claim 28 further comprises retracting the manipulable, extendible arm at the completion of the ordnance transfer procedure into the internal cargo space of the first airborne aerial vehicle.

34. The method of claim 28 further comprises feeding the at least one ordnance unit via an internally installed conveyor mechanism associated with the arm from the first airborne aerial vehicle to the second airborne aerial vehicle.

35. The method of claim 28 further comprises feeding the at least one ordnance unit via an externally installed ordnance conveyor mechanism

associated with the extendible, manipulable arm from the first airborne aerial vehicle to the second airborne aerial vehicle.

36. The method of claim 28 further comprises controllably moving the ordnance carriage cradle carrying the at least one ordnance unit or the at least one ordnance assembly from the first airborne aerial vehicle to the second airborne aerial vehicle along the extended arm assembly where the second end of the arm assembly.

37. The method of claim 28 further comprises transferring the at least one ordnance unit in a fuzed state with an associated at least one arming cable where the first end of the arming cable is attached to the fuzing device.

38. The method of claim 28 further comprises:

extracting an at least one previously used arming cable from the pylon; and

attaching the second end of the arming cable to the pylon.

39. The method of claim 28 further comprises the step aborting the ordnance transfer comprises the retrieval of the arm.

40. The method of claim 39 wherein the step of aborting the ordnance transfer comprises jettisoning of the arm or the ordnance, or the ordnance carriage cradle or at least one part of the arm.